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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/683,985	03/08/2002	Steven H. Voldman	BUR920020014	2597

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IBM MICROELECTRONICS
INTELLECTUAL PROPERTY LAW
1000 RIVER STREET
972 E
ESSEX JUNCTION, VT 05452

EXAMINER

NADAV, ORI

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 06/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/683,985

Applicant(s)

VOLDMAN, STEVEN H.

Examiner

Ori Nadav

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 April 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 26-43 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 26-43 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 27-28, 30-31 and 41 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitations of isolation regions, as recited in claims 27-28, 30-31 and 41, are unclear as to structural relationship between the isolation regions and the diode.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 26, 29, 35, 37 and 39-40 are rejected under 35 U.S.C. 102(b) as being anticipated by Murakami et al. (5,430,311).

Regarding claims 26 and 29, Murakami et al. teach in figure 1 and related text a method of forming a diode comprising the steps of providing an original substrate 1 not doped with anode and cathode regions and forming an anode 15 of a first conductivity type and a cathode 14 of a second conductivity type disposed below said anode on said

original substrate without removing any portion of said original substrate and without replacing with another substrate material, wherein at least one of said cathode and anode comprise a plurality of vertically abutting diffusion regions, wherein

said step of forming said cathode comprises forming a first doped region 14 of a second conductivity type abutting said anode, and forming a second doped region 13 of said second conductivity type abutting and disposed below said first doped region and contacting said original substrate, said first and second doped regions having different dopant concentrations.

Regarding claim 35, Murakami et al. teach in figure 1 and related text the step of forming said anode comprises the steps of:

forming a first doped region 15 abutting said cathode; and

forming a second doped region 16 on a surface of said substrate, said second doped region having a higher concentration of dopant than said first doped region.

Regarding claim 37, Murakami et al. teach in figure 5 and related text the steps of forming a plurality of diffusion regions 17 of said second conductivity type on a surface of said substrate.

Regarding claims 39-40, Murakami et al. teach in figure 5 and related text said cathode being in electrical contact with said substrate and is disposed entirely below said anode,

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 28, 31-33, 38 and 41-43, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al. in view of Beasom (5,841,169).

Regarding claims 28, 31, 41 and 43, Murakami et al. teach in figure 1 and related text substantially the entire claimed structure, as applied to claim 26 above, except plurality of isolation regions.

Beasom teaches in figure 2 and related text the step of forming plurality of tapered isolation regions 209, 219.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form plurality of tapered isolation regions in Murakami et al.'s device in order to improve the isolation of the device.

Regarding claims 31 and 32, Beasom teaches in figure 2 and related text isolation regions are formed by a process comprising the steps of etching said substrate to form trenches and depositing at least one insulator and a fill material. Beasom does not teach removing portions of said insulator outside of said trenches. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form

Art Unit: 2811

the isolation regions as taught by Beasom and to remove portions of said insulator outside of said trenches in order to form the device as depicted in figure 2 of Beasom.

Regarding claims 33 and 42, Beasom teaches in figure 2 and related text a single crystal substrate and the step of forming said cathode further comprises the step of forming a third doped region 206 disposed between said first doped region and said second doped region. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a single crystal substrate and a third doped region between said first doped region and said second doped region in Murakami et al.'s device in order to improve the characteristics of the device.

Regarding claims 38 and 43, Beasom teaches in figure 2 and related text the step of forming a plurality of second isolation regions 209, 219 that separate said plurality of diffusion regions from said cathode, and

forming a plurality of isolation regions in said original substrate, said cathode and anode being disposed between adjacent ones of said plurality of isolation regions, said plurality of isolation regions extending deeper into said original substrate than said cathode and said anode.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use form a plurality of second isolation regions that separate said plurality of diffusion regions from said cathode, and a plurality of isolation regions in said original substrate, wherein said cathode and anode being disposed between

adjacent ones of said plurality of isolation regions, and said plurality of isolation regions extending deeper into said original substrate than said cathode and said anode in Murakami et al.'s device in order to improve the isolation of the device.

Claims 27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al. in view of Mack et al. (4,736,271).

Regarding claim 27, Murakami et al. teach in figure 1 and related text teaches substantially the entire claimed structure, as applied to claim 26 above, except a plurality of insulation-filled trenches having sidewalls that are substantially vertical.

Mack et al. teach in figure 11, a plurality of insulation-filled structures having sidewalls that are substantially vertical. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the plurality of insulation-filled trenches of Murakami et al.'s device with sidewalls that are substantially vertical in order to simplify the processing steps of making the device.

Regarding claim 30, Murakami et al. teach in figure 1 and related text teaches substantially the entire claimed structure, as applied to claims 26 and 29 above, except forming a second pair of isolation structures between said adjacent isolation regions and said anode.

Mack et al. teach in figure 11 forming a second pair of isolation structures 30 between said adjacent isolation regions 30 and anode 54, 60. It would have been obvious to a

person of ordinary skill in the art at the time the invention was made to form a second pair of isolation structures between said adjacent isolation regions and said anode in Murakami et al.'s device in order to provide better electrical isolation for the anode.

Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al. in view of Robinson et al. (5,268,316).

Murakami et al. teach in figure 1 and related text teaches substantially the entire claimed structure, as applied to claims 26 and 35 above, except a first doped region comprises a retrograde-doped region. Robinson et al. teach a first doped region comprises a retrograde-doped region (column 3, lines 36-47). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the first doped region comprises a retrograde-doped region in Murakami et al.'s device in order to provide low-reverse leakage, a relatively low voltage turn-on, and low series resistance for the current path from the junction to the diode contact.

Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al. and Beason, as applied to claim 33 above, and further in view of Robinson et al. (5,268,316).

Murakami et al. and Beason teach substantially the entire claimed structure, as applied to claims 26, 29 and 33 above, except a third doped region comprises a retrograde-

Art Unit: 2811

doped region. Robinson et al. teach a third doped region comprises a retrograde-doped region (column 3, lines 36-47). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a third doped region comprises a retrograde-doped region in Murakami et al. and Beasom's device in order to provide low-reverse leakage, a relatively low voltage turn-on, and low series resistance for the current path from the junction to the diode contact.

Response to Arguments

Applicant's arguments with respect to claims 26-43 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Art Unit: 2811

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Ori Nadav', is positioned above the printed name.

O.N.
6/17/06

ORI NADAV
PRIMARY EXAMINER
TECHNOLOGY CENTER 2800